CENTRAL INTELLIGENCE AGENCY

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Tube Development Facilities in the USSR

1. NII 160 is the primary development center for vacuum tubes in the USSR. 25X1

other facilities are doing development work; for example, Zavod 652 (the so-called "Elektro Zavod") in Moscow is working on the development of cathode ray tubes from the RCA "preferred list." However, they have only a small laboratory, and no capacity for development such as exists at NII 160. Although NII 160 has production facilities, its primary mission is development rather than manufacturing. the reverse is true in other facilities. 25X1 25X1

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2. the present Soviet activity in the field of research and development on vacuum tubes has resulted in a product whose quality is on a par with Western vacuum tubes. Most of the Soviet tube types are exact copies of Western tube types and therefore there are almost no constructional differences between them. The Soviets have solved most problems which impair performance. the Soviets were having great difficulty in making glass tubes and metal bulbs for kinescopes, but were fully aware of the problems and were working on their solutions. /See below./

3. the Soviets cannot maintain their present position as far as vacuum tubes are concerned; they will lag behind the West because their capability for pursuing original future development is limited.

4. there was never a program among any of the development groups, and certainly not in the field of cathode ray tubes, devoted to making a tube superior to the world standard. The general program was only to copy

5. a multi-channel switching tube which is quite advanced. This tube used the orthicon beam principle to accomplish 20-channel switching, and the principle proved to be simple and reliable.

6. the tube manufacturing plants at Tashkent and Saratov do not have development laboratories. reasons are the following:

a. only the slightest clues that any work at all was conducted at Tashkent, whereas all other institutes and facilities were heard from frequently. accordingly, operations have only recently commenced and development work, if any, must be correspondingly small.

Tubes in Development Stages in the USSR

7. a list of the tubes under development at Zavod 632.

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[redacted] this list showed that Zavod 632 was developing the following oscillograph tubes: 3 DP-1 (using polarized deflection); 3 BP-1 (without polarized deflection); a 5" tube with post acceleration. In addition to the above three, [redacted] the 5 FP-7 for PPI's was on it, and a 3" tube having a long gun. The list contained mostly 3- and 5-inch tubes. It was general knowledge that Zavod 632 was also working on 9" and 12" PPI tubes having ground, spherical face plates and long persistence, and that it was also working on a 7" kinescope. 25X1 25X1

8. [redacted] a 16" kinescope, which had a square steel cone and employed an electrostatic deflection system. The tube had a low focusing voltage and an ion trap, and the development work, which was being done at NII 160, was almost complete [redacted] the Soviets had developed both steel and glass kinescopes, but they were not at the stage from which they could be put into production. [redacted] 25X1 25X1 25X1

9. [redacted] Although in some departments of NII 160 the Germans helped in preparing plan figures, [redacted] Even where the Germans did have something to do with the plan, [redacted] they had influence mostly over the terminal dates of the projects rather than over the fiscal details. The Ministry, [redacted] did not make any rule that the Germans have no contact with the plan figures, but two factors inhibited such contacts greatly. First, many of the Soviet department heads would not allow such contacts and, second, most of the Germans were unwilling to accept any responsibility for matters they couldn't later exercise any control over and therefore avoided contact with the budget. 25X1 25X1 25X1 25X1

10. [redacted] 25X1

Tubes in Production Stage in the USSR

11. The only cathode ray tubes [redacted] in mass production were the 7-inch size. There was a rather large quantity of these being produced. There was limited production of 9- and 12-inch tubes. 25X1

12. In order to get 20 good dark-trace cathode ray tubes, it was necessary for NII 160 to start no more than 40 tubes, but [redacted] it would be more likely that 30 were started. For more ordinary cathode ray tubes the Institute had a shrinkage of 10 to 20 percent. 25X1

13. After the Soviet engineers had seen the bad effect of ion bombardment in cathode ray tubes, they decided to incorporate

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ion traps in future types. The ion trap, used most frequently, was the Bentgen (DuMont) trap, using a triode system. Most of the tubes were given life tests at 50 microamperes, at which level the life had to be 1,500 hours.

14. The high-pressure mercury lamps used to illuminate the dark-trace tubes were exact copies of the old Osram lamp used in Germany during the war for the same purpose. Originally Osram made a range of these bulbs from 50 to 1,000 watts in size. Later OSW took over production of the bulb. They worked very well with DC and had a life of about 500 hours. With AC applied to the bulb, however, they did not work nearly as well and the life was reduced to something like 100 or 150 hours. This reduced life was the result of the sputtering of the cathodes which occurred when an alternating voltage was applied.

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Production of Tube Machinery

15. The development of tube making machinery was the responsibility of a section referred to as OKB-M, physically located in the same buildings as NII 160. NII 160 and OKB-M were in the same Ministry but were not in the same chief directorate. The OKB was responsible, however, for the development of all machinery necessary for any chief directorate of the Ministry. it worked on the development of machinery for the automatic finishing of kine-scopes. This project was to develop all the machinery for a production line with a capacity of 100,000 cathode ray tubes a month.

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16. There was astonishingly good cooperation between Zavod 632 and NII 160 as far as exchange of ideas is concerned. Also, since OKB-M did the development work for machinery for the entire Ministry, OKB-M furnished 632 with plans, blueprints, and possibly sample machines for production machinery for this latter plant.

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17. During the war, Tungsram of Budapest, Hungary, furnished NII 160 with tube machinery. This was taken from the Hungarian company by the Soviets, These machines were still in place in NII 160,

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Glass Supply to NII 160

18. The glass supply at NII 160 came from three sources: A plant in Zaprudnaya, a plant in Moscow, and the Institute's own glass plant. Considerable difficulty was experienced with the glass from the Institute's own plant. the glass plant had capacity enough to supply all the glass that was needed by the Institute, but the quality was very poor, hence

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Electronics Systems Development in the USSR.

23. The Soviets seemed to be very interested in the development of systems, using electrostatic deflection.

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it would be much easier to use electromagnetic systems, the possible difficulties that they might have with electrostatic systems. However, in spite of the difficulties, which they encountered, they were still working on electrostatic deflection systems It is of course possible that parallel work was being done on electromagnetic deflection systems,

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25. where the lens and mechanical system for the Schmidt optical system were made,

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Makautov, who developed a similar projection system, is still active in Leningrad, and he is reputed to be a very highly qualified man in the general field of optics.

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Tube Materials in the USSR

26. the materials used in cathode ray tubes is the mica, which was of good quality, came from Siberia. The supply seemed adequate

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27. Alba getters were used in most of the cathode ray tubes. They were stabilized and were very active. Since the Soviets used standards in the design of cathode ray tubes, even the lumina forces were exactly the same as the tubes they were copied from. The various screen-coating materials used included $ZnSiO_x$, ZnO, ZnS, Zn-Ca-S, and ZnS-ZnSe.

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ZnO was made from zinc oxalate rather than from zinc sulphide, and later activated with cerium. This coating had a persistence smaller than 5×10^{-8}, which was the limit of the test equipment.

28. One of the two best German specialists on the coating of screens is still in Moscow. His name is Riehl. In addition, the Soviets had obtained all the equipment from the factory run by the other of these two specialists, a man by the name of

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the dependence on outside suppliers. [redacted] which glass plant supplied what percentage of the Institute's requirements [redacted] changed from time to time. 25X1 25X1

19. [redacted] 25X1

20. The glass factory at Zaprudnaya was set up to manufacture lamp-bulb glass and the greatest part of its production was this type of glass. Most of it went to the Elektro Zavod, number 632, in Moscow. This plant, however, made kinescope bulbs. Many of these were blown in full form, but they also made the divided type. [redacted] if they ground face plates at this factory; [redacted] the blanks, grinding machinery was available at NII 160. [redacted] 25X1 [redacted] the plant capacity for glass manufacture at this plant must have been considerable. They had at least three ovens there, and [redacted] the largest had a capacity of 250 tons. [redacted] another had a 100-ton capacity and the other was of comparable size. The plant was set up for continuous glass making. 25X1 25X1

21. Naturally, NII 160's demands on the plant were minor from a quantity point of view, but they did put some quality restrictions on the glass factory. The most serious problem that was faced in making kinescope and oscillograph tubes was that of getting glass for the bulbs. There was no mass production of tube bulbs, and the cost of such bulbs reflected the difficulty of making them. [redacted] a 12" bulb cost 5,000 rubles. The Soviets knew that this was their major bottleneck and were working on improving the supply system for glass bulbs. 25X1

General Comments on Magnetron Development Work

22. [redacted] work in this field was the only work in the entire program for development of vacuum tubes wherein the Soviets accomplished any results on their own. [redacted] their work in this field as definitely progressive. Even when they did copying of magnetrons, procured from other countries, the work was conducted in a more efficient manner than in the case of other tubes. 25X1 25X1

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Kamm. When the Soviets took over his East German factory and moved the machinery to NII 160, Kamm defected

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